1.0 EXECUTIVE SUMMARY

Segmentation systems are a geographical subdivision of a natural landscape feature, in this case an estuary. Ideally, each subdivision or segment is a subset of the whole that reflects uniform characteristics across the segment. This idealization is seldom possible, since estuarine segments are interconnected and tend to form gradients for most characteristics.

Management activities, monitoring programs, and characterization studies are all enhanced by segmentation of the estuary into smaller more manageable units. Future management effectiveness can be improved by the geographic targeting of areas that may have defined impacts and require unique attention. During characterization, segmentation provides a rationale for grouping data to describe various portions of the estuary. This grouping of the data may also facilitate the intercomparison between segments of the estuary.

Systems of segmentation within an estuary provide three major roles in estuarine management. Existing information can be grouped and examined for spatial variations and similarities. Secondly, they are central to the effective design of estuarine monitoring projects, allowing the effort to be balanced or apportioned appropriately. Finally, segmentation facilitates both data reduction and presentation. Results are more easily understood when they are referenced to recognizable subareas.

1.1 Project Description

The purpose of this study is to develop a segmentation scheme for the Galveston Bay System that will facilitate the other efforts planned by the Galveston Bay National Estuary Program (GBNEP). The study is organized around four tasks: 1) the evaluation of existing segmentation schemes, 2) evaluation of natural features and anthropogenic inputs, 3) determination of segmentation criteria, 4) and the drafting of the boundaries. To facilitate the management and presentation of the large amounts of geobased data accumulated, a geographic information system (GIS) was developed for the study area.

Estevez and Palmer (1989) stated that segmentation systems have been used historically as a data management tool and that data within these segmentation systems should be labelled according to the segments of origin. They further listed three important roles segmentation systems play in estuarine management as:

- causing existing information on a system to be reviewed for the purpose of defining landscape-level diversity, and the similarity or dissimilarity of areas within the system;

- facilitating the design of data collection projects and simplifying the review of historic data; and

- simplifying data reduction, analysis, and presentation.

Several segmentation schemes currently exist for Galveston Bay, particularly with respect to natural resources data. Both State and Federal natural resource agencies collect data for the management of resources within Galveston Bay. These agencies include but are not limited to the Texas Water Commission (TWC), Texas Parks and Wildlife Department (TPWD), the U.S. Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), and the National Oceanographic and Atmospheric Administration (NOAA). A brief description of data collected by and segmentation schemes used by these agencies that may be useful in developing a segmentation scheme for Galveston Bay is presented in Section 3 of this report. The emphasis is primarily on aquatic resources.

1.2 Description of Study Area

The study area, the Galveston Bay System, is a large bay-estuary-lagoon system. The study area is shown in Figure 1. The system is composed of Galveston Bay, Trinity Bay, East Bay, West Bay, and a number of smaller embayments, all interconnected. Area watershed boundaries are shown in Figure 2. The system is separated from the Gulf of Mexico and the inner continental shelf by a geologically modern barrier island complex, Galveston and Follets Islands, and peninsula complex, Bolivar Peninsula.

Galveston Bay is subject to a wide variation in tidal extremes, fresh water input, pollutant loadings from domestic and industrial point and non-point sources, occasional severe weather systems, and variable temperature regimes. Alteration of the Bay by human activity has changed the circulation patterns of the system through the dredging of channels, spoil bank placement, and the construction of jetties, marinas, docks, and causeways. The inherent shallow character of Galveston Bay combined with its long reaches of open water and exposure to continuous wind make mixing of the water column pronounced (UTMSI, 1973).

Texas estuaries are generally of two geomorphological types: 1) coastal plain, composed of drowned river mouths and 2) bar built, in which an offshore sand bar partially encloses a body of water (Pritchard, 1967). The Galveston Bay system exhibits both. Galveston and Trinity Bays are examples of the coastal plain drowned river mouths. East Bay and West Bay are examples of bar built bays. Smaller embayments included in the Galveston Bay system include Clear Lake, Dickinson Bay, Chocolate Bay, Bastrop Bay, Christmas Bay, Dollar Bay, Jones Bay, Tabbs Bay, San Jacinto Bay, Moses Lake, and Drum Bay.

Two major rivers, the Trinity River and the San Jacinto River, discharge into the estuary. In addition, a number of smaller tributaries discharge into the system including Bastrop Bayou, Chocolate Bayou, Halls Bayou, Dickinson Bayou, Clear Creek, Buffalo Bayou, Cedar Bayou, and Double Bayou. Figure 2 is a drainage basin map for the larger tributaries to Galveston Bay.

Of the existing segmentation schemes reviewed, the Texas Water Commission scheme and the University of Texas Center for Research in Water Resources Scheme, which was a hydrographic subdivision of the TWC scheme satisfied the criteria the best. The TWC segmentation scheme encompasses a number of criteria uses including administrative and monitoring and subdivides the study area for this project into 29 segments. The results of this study subdivide the area into 44 segments which are described in more detail and shown on maps of the area.

Galveston Bay National Estuary Program

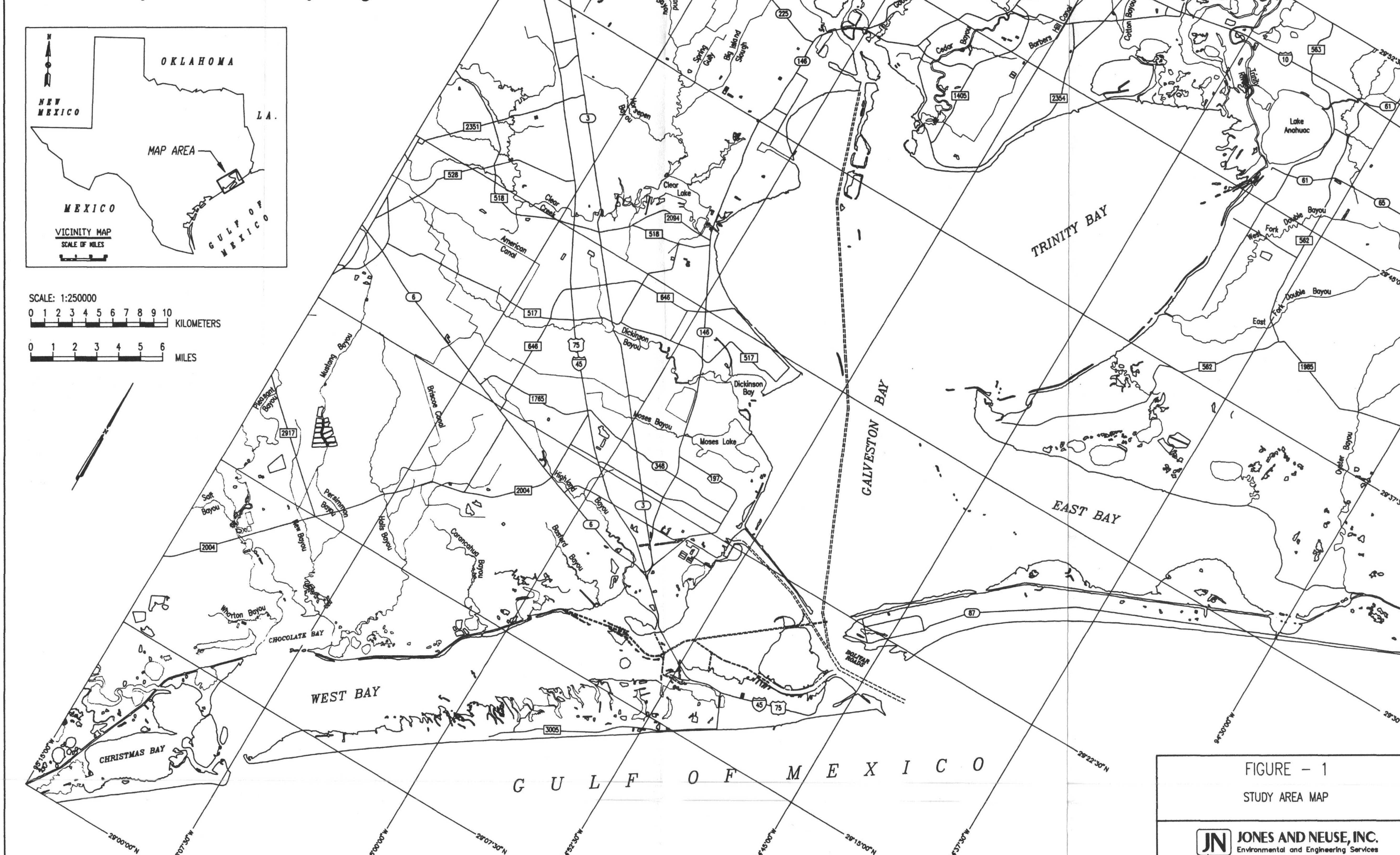
OKLAHOMA
NEW MEXICO
LA.
MAP AREA
MEXICO
GULF OF MEXICO
VICINITY MAP
SCALE OF MILES
SCALE: 1:250000
0 1 2 3 4 5 6 7 8 9 10 KILOMETERS
0 1 2 3 4 5 6 MILES
N
TRINITY BAY
GALVESTON BAY
EAST BAY
WEST BAY
CHOCOLATE BAY
CHRISTMAS BAY
GULF OF MEXICO
BOLIVAR ROADS
Clear Lake
Lake Anahuac
Dickinson Bay
Moses Lake
Armand Bayou
Spring Gully
Big Island Slough
Horsepen Bayou
Clear Creek
American Canal
Dickinson Bayou
Moses Bayou
Highland Bayou
Basford Bayou
Carancahua Bayou
Hollis Bayou
New Bayou
Persimmon Bayou
Salt Bayou
Pleasant Bayou
Mustang Bayou
Briscoe Canal
Wharton Bayou
Goose Creek
East Fork
Cedar Bayou
Barbers Hill Canal
Cotton Bayou
Old River
Trinity River
West Fork Double Bayou
East Fork Double Bayou
Oyster Bayou
29°52'30"N
29°45'00"N
29°37'30"N
29°30'00"N
29°22'30"N
29°15'00"N
29°07'30"N
29°00'00"N
95°15'00"W
95°07'30"W
95°00'00"W
94°52'30"W
94°45'00"W
94°37'30"W
94°30'00"W

FIGURE – 1

STUDY AREA MAP

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SCALE: 1:250000

0 1 2 3 4 5 6 7 8 9 10 KILOMETERS

0 1 2 3 4 5 6 MILES

LEGEND

Watershed Boundaries

Vince Bayou
Armand Bayou
Buffalo Bayou
San Jacinto River
Goose Creek
East Fork Goose Creek
Cedar Bayou
Cotton Bayou
Old River
Lost River
Trinity River
Lake Anahuac
Turtle Bayou
Boggy Bayou
Spring Gully
Big Island Slough
Barbers Hill Canal
Armand Bayou
Clear Creek
Clear Lake
Robinson Bayou
American Canal
TRINITY BAY
Double Bayou
West Fork Double Bayou
East Fork Double Bayou
New Bayou
Mustang Bayou
Dickinson Bayou
Dickinson Bay
Cottonwood Bayou
West Bay Bayou
Chocolate Bayou
Halls Bayou
Briscoe Canal
Moses Bayou
Moses Lake
Highland Bayou
Oyster Bayou
GALVESTON BAY
EAST BAY
Salt Bayou
Persimmon Bayou
Hall Bayou
Basford Bayou
Whorton Bayou
CHOCOLATE BAY
Carancahua Bayou
Basford Bayou
BOLIVAR ROADS
WEST BAY
CHRISTMAS BAY
GULF OF MEXICO
95°15'00"W
95°07'30"W
95°00'00"W
94°52'30"W
94°45'00"W
94°37'30"W
94°30'00"W
29°37'30"N
29°30'00"N
29°22'30"N
29°15'00"N
29°07'30"N
29°00'00"N

FIGURE – 2

AREA WATERSHEDS
GALVESTON BAY SYSTEM

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